NORTHWEST TERRITORIES POWER CORPORATION

Greenhouse Gas Report

2005/06

TABLE OF CONTENTS

Message from our President 1
Introduction 2
- Corporate Profile 2
- Commitment to Reducing Greenhouse Gas Emissions 3
- Management System 4
- External Verification 4

Base Year Quantification 5
- Baseline Quantification 5
- Direct and Indirect Emissions 5
- Emissions Calculations 6
- Forecast Emissions 6

2005/2006 Greenhouse Gas Emissions 7
- Hydropower Generation 7
- Diesel Generated Power 7
- Natural Gas Generated Power 8
- Actual Emissions for 2005/06 8
- Emissions Intensity 9
- Forecast Emissions 9
- Natural Gas Generation Developments 10
- Business as Usual Forecasting 10
- Emissions Reductions Targets 11

Results Achieved and Measures to Achieve Results 12
- Fuel Efficient Engine Upgrades 12
- Programmable Logic Controllers (PLC) 13
- Reduction in Station Service / Residual Heat Recovery 13
- Colville Lake Residual Heat Project 14
- Alternative Generation Fuels / Methods 15
  - Bluefish Hydro Purchase 15
  - Proposed Hydro Developments 15
  - Mini Hydro in Lutsel K'e 16
- Streetlight Replacement 16
- Transmission and Distribution Lines 16
- Residential Energy Efficiency Program 16
- Results in Comparison to Targets 17
  - GHG Emissions 17
  - CO_2e Station Service Target 17

Climate Change Awareness 18
- Internal Communications 19

Conclusion 20
- Contact Information 20

APPENDIX A 21

Message from our President

The Northwest Territories Power Corporation (NTPC) is pleased to submit this greenhouse gas (GHG) report to the Canadian GHG Challenge Registry. Since NTPC's first GHG report submission in 1999 to the Voluntary Challenge and Registry Inc. we have annually achieved Gold Champion Level Reporting Status. With the *Best New Submission* award in 1999 and the *Leadership Award for the Electricity Sector* in 2000/01, NTPC has set a high standard for itself to maintain. NTPC's submission of this 2005/06 Progress Report illustrates our continued commitment to regular reporting and initiatives to reduce GHG emissions.

In 2005/06 NTPC produced 59,545 Tonnes of $C0_2$ equivalent GHG emissions, a successful decrease of 58% from 1990/91 levels (Baseline). NTPC decreased total generation by 30,498 MWh from 2004/05 to 341,949 MWh due to a decrease in industrial load. This made more hydropower available to Yellowknife from the Snare and Bluefish hydro facilities which in turn decreased the requirement for diesel generated power in that community. In addition to reducing our diesel generation, further GHG reduction initiatives such as station service reduction and the installation of more efficient streetlights have continued.

NTPC has been successful in decreasing its greenhouse gas emissions to well below both the 1990 Baseline levels and our internal target of 10 percent below 1996/97 levels, yet we strive to further reduce emissions where feasible. Through programs to increase Corporation-wide fuel efficiency, reduce our own station service demands, promote public awareness of energy efficiency, and carry out research into alternative sources of power generation, NTPC will continue to reduce its production of greenhouse gases.

Through regular reporting to the Canadian GHG Challenge Registry we will monitor our initiatives, progress, and success in reducing greenhouse gas emissions in the north.

Sincerely,

Leon Courneya

Leon Courneya
President and Chief Executive Officer

INTRODUCTION

The Canadian GHG Challenge Registry (Registry) provides a nationally recognized and reviewed avenue for businesses to report Greenhouse Gas (GHG) emissions. Through the Registry, the Northwest Territories Power Corporation (NTPC, Corporation) demonstrates its ongoing commitment to voluntarily reduce GHG emissions. Since our first annual submission to the Voluntary Challenge and Registry (predecessor to the Registry) in 1999, we have achieved Gold Champion Level Reporting Status yearly. We also received the *Best New Submission* award in 1999 and the *Leadership Award for the Electric Utilities Sector* in 2001 as well as honourable mentions in 1999 and 2003 for the Leadership Award. NTPC is proud to present our 2005/06 GHG report. In this report, we quantify our air emissions and outline the many initiatives taken to further reduce GHG emissions and help preserve one of the world's most beautiful and pristine environments.

Corporate Profile

The Northwest Territories Power Corporation is a Crown corporation wholly owned by the Government of the Northwest Territories. NTPC was created in 1988 when the Territorial Government purchased shares of the federally owned Northern Canada Power Commission. Today we are the primary power producer in the Northwest Territories (NWT). We distribute electricity to the end-use consumer in 27 communities and supply electricity on a wholesale basis to two distributing utilities. These utilities in turn retail electricity to customers in the Yellowknife and Hay River areas. As a Crown corporation we have a mandate to operate as a viable business enterprise.

NTPC operates 31 power plants including the standby diesel generation facilities within the Bluefish, Snare, and Taltson hydro systems and the Inuvik and Norman Wells natural gas systems. NTPC's facilities include hydroelectric, diesel, and natural gas generation plants, as well as transmission systems and numerous isolated electrical distribution systems. NTPC purchases and distributes natural gas generated power in Norman Wells. We also own and operate alternative energy assets used for the supply of residual heat in several communities. Figure 1 shows the NWT and the locations of communities served by NTPC.

Figure 1: NTPC Service Area

NTPC serves a population of approximately 42,000 people located in an area of 1.2 million square kilometers. Approximately 67% of the population lives in the North and South Slave regions, while the rest of the population resides in small communities widely dispersed throughout the NWT. The total electrical load for the NWT is approximately 65 MW, with isolated power systems having generating capacities ranging from 190 kW at Colville Lake to 59.6 MW at Snare/Yellowknife. As these systems are isolated and unconnected, each must be planned for and operated independently.

Commitment to Reducing Greenhouse Gas Emissions

NTPC operates within a Corporate Strategic Plan, developed in 1997 and reviewed regularly by Senior Management and the Board of Directors. The following initiatives are outlined in the Strategic Plan to maintain or further decrease our production of GHG emissions:

- We will reduce GHG emissions on a per kilowatt-hour basis by 10% from 1996/97 levels within 10 years.
- We will endeavour to increase our supply-side energy efficiencies by increasing our use of technologies such as the Internet, Turtle meters, more fuel-efficient engines, Programmable Logic Controllers (PLCs), and more efficient streetlights to reduce our costs, improve plant efficiencies, and reduce GHG emissions.
- We will strive to increase our own energy efficiencies through efforts to decrease station service at our plants and offices and increase the use of residual heat within our own facilities.
- We will develop residual heat projects in as many communities as is economically feasible. While this does not directly reduce our own GHG emissions, it reduces the amount of diesel fuel required for heating within a community as well as for transportation of that fuel to the community; an indirect GHG reduction.
- We will assist in the development of natural gas infrastructure independently and in joint ventures to ensure a supply of gas for power generation and to decrease the production of GHG emissions.
- We will pursue additional hydro opportunities for the NWT and strive to provide additional hydroelectricity for mines.
- We will monitor the development of alternate power generation technologies such as wind, solar power generation, and fuel cells.
- We will encourage conservation of energy through customer education programs: through demand-side energy conservation, we reduce the amount of energy required by customers. This results in less diesel fuel burned to meet community electricity demands, particularly in the more remote communities. Less fuel required in a community translates into reductions of GHG emissions produced in transporting fuel to the community, an indirect saving.

Although we have already achieved our target to reduce GHG emissions by 10% of 1996/97 levels, we will continue to further decrease our production of GHG emissions where feasible.

NTPC has developed an ISO 14001 compliant Environmental Management System (EMS). The EMS includes a review of current climate change practices implemented by NTPC, which will help develop and monitor new targets.

Management System

Our GHG emissions are monitored at the most senior levels of NTPC by the Board of Directors and the President and CEO. Senior Management not only review and approve NTPC's Strategic Plan, but review and approve any GHG initiatives through the annual capital and financial planning process. The Minister Responsible for NTPC is also kept advised of all major issues regarding NTPC including our GHG reduction programs.

Through our annual GHG submission we analyze and monitor NTPC's success in reducing GHG emissions. Corporate data from the Environmental, Financial, and Engineering departments is compiled, analyzed and reviewed at a management level to generate the GHG report. The President and CEO reviews the report prior to submission to the Registry. Once submitted, NTPC's GHG emissions status is reported to both the Board of Directors and the Minister.

External Verification

The Auditor General of Canada annually carries out external verification of Corporation data, including fuel consumption and generation statistics.

Through the Public Utilities Board (PUB) process for setting power rates all aspects of our operations, including our GHG initiatives and their associated costs and benefits, are reviewed publicly and by the PUB.

In 2003 Environment Canada's National Pollutant Release Inventory (NPRI) introduced Criteria Air Contaminants (CACs) into their list of toxic substances to be reported annually. NTPC now reports emissions annually to the NPRI as well as to the Registry.

BASE YEAR QUANTIFICATION

NTPC used the 1990/91 fiscal year to create a Baseline for emissions against which to compare subsequent years.

Baseline Quantification

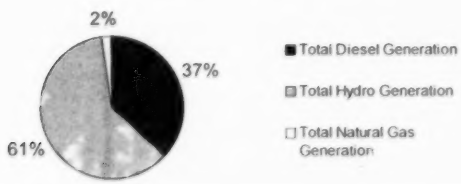
Emission factors from the 2005 Canadian Greenhouse Gas Challenge Registry Guide were used to calculate emissions. Table 1 illustrates our 1990/91 Baseline emissions according to GHG type.

Table 1: Baseline Emissions Estimates by Greenhouse Gas Type

	Tonnes			
Fiscal Year	**CO_2**	**CH_4**	**N_2O**	**CO_2 Equivalent Total Emissions**
1990/91	134,588	8	19	140,723

Hydro, diesel, and purchased natural gas generated power accounted for 61%, 37%, and 2% of total generation in 1990/91, respectively. Figure 2 illustrates 1990/91 percent generation according to source.

Figure 2: Power Generation by Source for 1990/91 (Baseline Year)



Direct and Indirect Emissions

NTPC's direct GHG emissions result from the combustion of fossil fuels to generate electricity in Corporation-owned diesel and natural gas facilities.

Indirect emissions are those created or saved by operations not directly controlled by NTPC, but affected by Corporation business decisions. These include emissions produced from purchased natural gas generated power and emissions saved as the result of residual heat projects providing heat to buildings not owned by NTPC.

In 1990/91 NTPC did not own any natural gas generating facilities. All natural gas generation emissions at that time were therefore indirect emissions resulting from the purchase of natural gas generated power in Norman Wells. Table 2 illustrates NTPC's emissions according to source for 1990/91.

Table 2: Baseline GHG Emissions by Source

	CO_2 Equivalent Tonnes		
Fiscal Year	**Diesel Generation**	**Gas Generation**	**Total Emissions**
1990/91	136,555	4,168	140,723

Emissions Calculations

Greenhouse gas emissions to date have been calculated using NTPC's actual fuel consumption data for the periods covering 1990/91 to 2005/06. Combusted fuel is converted to GHG emissions using the emissions factors provided in the Registry Guide, as follows:

Table 3: Emissions Factors by Gas Type

Source	CO_2	CH_4	N_2O
Natural Gas Industrial Boiler	1,891 g/m^3	0.49 g/m^3	0.049 g/m^3
Diesel Motor	2,730 g/L	0.13 g/L	0.40 g/L

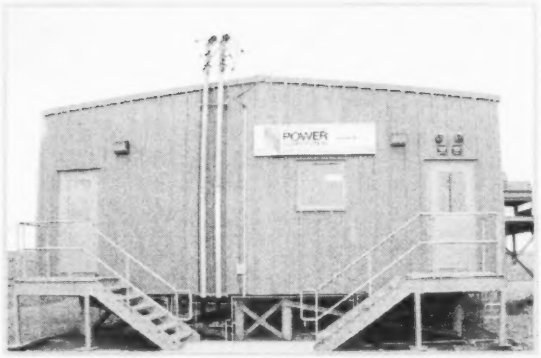
The following equivalency factors provided in the Registry Guide were utilized to calculate GHG carbon dioxide equivalency (CO_2 e):

Table 4: Carbon Dioxide Equivalency Factors

Greenhouse Gas Type	CO_2e Factor
CO_2	1
CH_4	21
N_2O	310

Corporation buildings heated by residual heat or electricity directly from Corporation power plants are included in emissions estimates, however emissions produced from oil-fired furnaces in Corporation owned housing, Corporation office buildings, etc. are not reported.

Due to the low number of Corporation owned vehicles (61 on average) and the limited distances driven annually, GHG emissions produced from vehicles are not included in this report.



Forecast Emissions

Forecast emissions are based on predicted future power generation values for 2006/07 to 2011/12, which are divided by three-year weighted averages for plant efficiencies to determine fuel consumption. This method of forecasting incorporates the previous year's improvements to fuel efficiencies, upgrades to streetlights and transmission lines, and reductions to station service.

Average hydro generation (assuming normal precipitation levels, as most water comes from runoff) is used to forecast the amount of diesel generation required for those communities where diesel generation supplements hydro generation.

2005/2006 GHG EMISSIONS

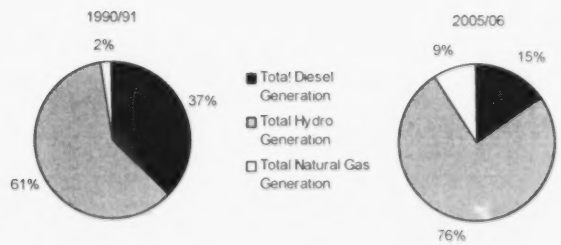
Diesel combustion for the production of power generation is our major source of GHG emissions. Since 1990 diesel generated emissions have accounted for an average of 88% of our total GHG emissions. The following section illustrates Corporation production of GHG emissions and the efforts taken in the last year to reduce our reliance on diesel generated power.

Hydropower Generation

Hydropower generation is dependent on water levels and thus varies from year to year. In years of low hydropower generation, diesel generation is increased to meet hydro shortfalls. The majority of NTPC's GHG emissions result from diesel generation, so when hydro generation is low, GHG emissions increase. 2005/06 was an average water year in which more hydropower was available for Yellowknife due to a decreased industrial demand, which reduced the need for diesel generation. GHG levels remain significantly below 1990/91 levels and have decreased from 2004/05 levels.

Hydropower is currently the cleanest power NTPC can provide to its customers. As diesel generation is utilized as backup power generation for the hydro systems, the more hydropower we are able to produce the more diesel generated power we displace. Figure 3 shows NTPC's average power generation by source for 1990/91 and 2005/06.

Figure 3: Average Power Generation by Source for 1990/91 and 2005/06



In 2005/06 the Bluefish, Snare, and Taltson hydro systems produced 42,880 MWh, 151,573 MWh, and 63,738 MWh of power, respectively. In the absence of hydropower, all this power would have been generated from diesel. Hydropower generation accounted for 75% of our total generation for 2005/06, a 14% increase over 1990/91 levels.

Diesel Generated Power

NTPC's consumption of diesel fuel for generation purposes, our major source of GHG emissions, has greatly decreased over the years. In 1990/91, 37% of total generation came from diesel generated power. In 2005/06, diesel generated power accounted for only 15% of total power generation. Our decreased reliance on diesel generated power has allowed us to reduce our diesel generated CO_2 equivalent emissions from 136,555 tonnes in 1990/91 by 69% to 42,456 tonnes in 2005/06, a reduction of 18,920 tonnes from 2004/05. Table 5 shows NTPC's CO_2 equivalent emissions from both direct and indirect generation sources.

Table 5: GHG Emissions Produced/Gen. Source

	Direct		Indirect	
	CO_2 Equivalent Emissions (Tonnes)			
Fiscal Year	Diesel Generation	Natural Gas Generation	Natural Gas Generation	Total Emissions
1990/91	136,555	0	4,168	140,723
1991/92	130,099	0	4,216	134,316
1992/93	132,223	0	4,245	136,468
1993/94	135,936	0	4,473	140,409
1994/95	177,699	0	4,446	182,146
1995/96	178,125	0	3,962	182,086
1996/97	123,637	0	3,755	127,391
1997/98	104,813	0	4,189	109,002
1998/99	93,505	0	4,213	97,718
1999/00	54,291	6,610	3,944	64,845
2000/01	49,284	11,293	3,891	64,468
2001/02	47,734	12,880	3,888	64,502
2002/03	63,297	12,716	3,969	79,982
2003/04	70,689	13,166	4,572	88,427
2004/05	61,375	13,274	4,367	79,017
2005/06	42,456	12,878	4,212	59,545

Natural Gas Generated Power

NTPC continues to replace diesel generated power with less GHG intensive natural gas generated power. In 1990/91 NTPC's only source of natural gas generated power was purchased power in Norman Wells. In 2005/06 NTPC produced 9% of its total generation from natural gas generated power; 7% NTPC-generated power and 2% purchased power. This means that NTPC successfully generated approximately 7% more natural gas generated power in 2005/06 than in 1990/91. Plans for the replacement of remaining Inuvik diesel engines with natural gas engines will result in a greater percentage of natural gas generated power in the future.

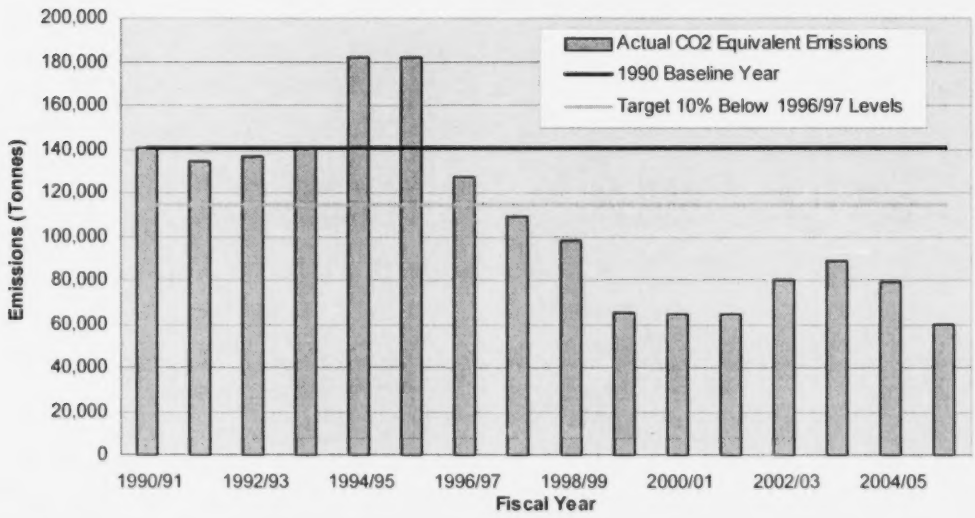
Actual Emissions for 2005/06

Once again NTPC was able to produce fewer emissions per MWh than in 1990/91. This was accomplished by maximizing hydro and natural gas generated power over the more GHG intensive diesel generation. In 2005/06 NTPC produced 59,545 tonnes of CO_2 equivalent emissions, a decrease of 58% from 1990/91 levels. NTPC's GHG emissions remain well below both the 1990/91 Baseline levels and NTPC's internal target of 10% below 1996/97 levels. Figure 4 illustrates NTPC's GHG emissions from 1990/91 to 2005/06 while Table 6 illustrates our GHG emissions according to gas type and emissions intensity from 1990/91 to 2005/06.

Table 6: GHG Emissions by Gas Type

	Tonnes				
Fiscal Year	CO_2	CH_4	N_2O	Total CO_2 Equivalent Emissions	Emissions Intensity (Tonnes/ MWh)
1990/91	134,588	8.35	19.22	140,723	0.377
1991/92	128,467	8.05	18.32	134,316	0.355
1992/93	130,525	8.15	18.62	136,468	0.340
1993/94	134,299	8.33	19.15	140,409	0.339
1994/95	174,184	10.21	24.99	182,146	0.447
1995/96	174,113	10.03	25.04	182,086	0.427
1996/97	121,838	7.51	17.40	127,391	0.302
1997/98	104,281	6.65	14.78	109,002	0.264
1998/99	93,502	5.94	13.20	97,718	0.264
1999/00	62,294	5.29	7.87	64,845	0.169
2000/01	62,080	6.12	7.29	64,468	0.167
2001/02	62,857	6.46	7.11	64,502	0.163
2002/03	76,952	7.15	9.29	79,982	0.200
2003/04	85,055	7.75	10.35	88,427	0.225
2004/05	76,059	7.30	9.04	79,017	0.212
2005/06	57,435	6.30	6.38	59,545	0.174

Figure 4: Total CO_2 Equivalent Emissions between 1990/91 and 2005/06



Emissions Intensity

Emissions intensity is a product of the CO_2 equivalent emissions produced in relation to our total power generation from all sources (tonnes/MWh). As diesel generated power is our major source of GHG emissions, the lower our emissions intensity the more successful we are at meeting our power generation demands from other, cleaner sources.

NTPC generated 4,269 MWh less hydropower, 25,359 MWh less diesel generated power, and generated/purchased 870 MWh less natural gas generated power in 2005/06 than in 2004/05. This translates into a GHG emissions intensity of 0.174 tonnes/MWh for 2005/06, an improvement on 0.212 tonnes/MWh from 2004/05 and well below the 0.377 tonnes/MWh from 1990/91.

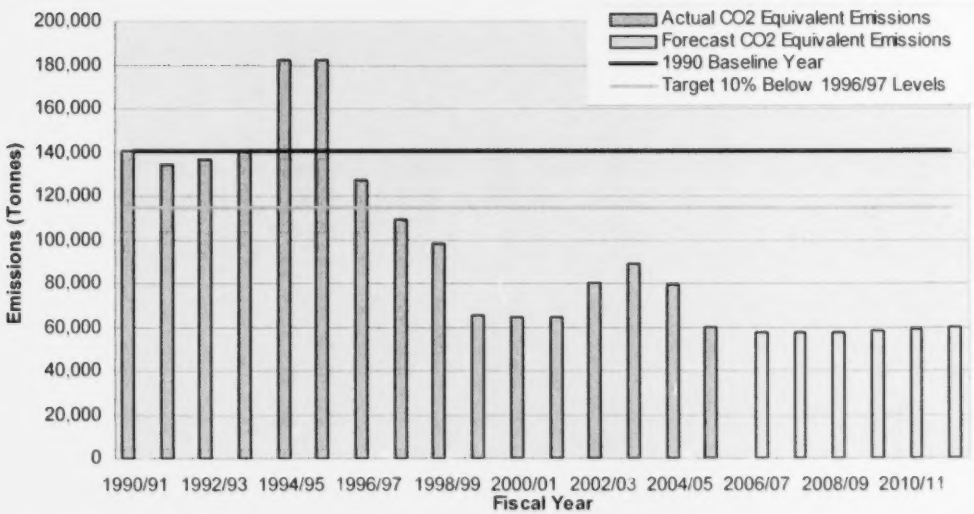
Forecast Emissions

NTPC's forecast GHG emissions for the period of 2006/07 to 2011/12 range from 58% to 60% below the 1990/91 Baseline levels. Figure 5 illustrates forecast CO_2 equivalent emissions to 2011/12.

Forecast hydro generation is based on a long-term average water level forecast, and has a large influence on NTPC forecast emissions. An average production of 43,000 MWh of hydropower per forecast year at Bluefish, 153,000 MWh at Snare, and 68,000 MWh at Taltson is forecast over the next six years. With average water levels anticipated, total emissions from 2006/07 to 2011/12 are expected to be significantly lower than 2005/06. This is due to the continued availability of Bluefish hydropower to displace diesel generated power in Yellowknife and the installation of an additional natural gas generator in Inuvik.

The Bluefish Hydro facility, originally owned by Miramar, was built to supply power to Yellowknife's Con Mine, also owned by Miramar. In November of 2003 Con Mine terminated mining operations, significantly reducing its electrical requirements. NTPC purchased the Bluefish Hydro facility, and hydropower no longer required by the mine is now available to meet Yellowknife power demands, thereby reducing diesel fuel consumption. Between 2006/07 and 2011/12 we anticipate using an average of only 362 kL of diesel fuel annually to meet Yellowknife demands. This will produce only 1033 tonnes of CO_2 equivalent emissions per year

Figure 5: Forecast CO_2 Equivalent Emissions as a Product of Total Generation



to service Yellowknife power demands, compared to the 55,923 tonnes produced in 1990/91. Figure 6 illustrates percent change in NTPC emissions relative to 1990/91 levels for actual and forecast years.

Natural Gas Generation Developments

As a result of converting NTPC's main generating station in Inuvik from diesel to natural gas in 1999, NTPC made it feasible for the producers and distributors of natural gas to expand their local market. NTPC introduced another natural gas generator into the Inuvik plant in January 2006 giving the plant the capability of supplying 100% of the town's power demand with natural gas generated power.

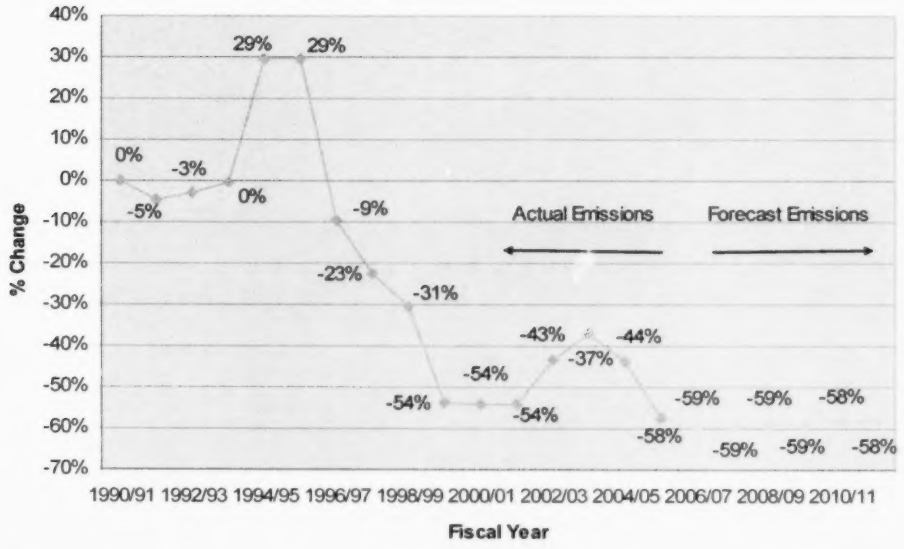
NTPC has been working with the Town of Inuvik since 2002 with the installation and operation of two natural gas fired micro-turbine units to supply combined electricity and residual heat to the Town's recreation complex. This demonstration project is NTPC's first venture involving micro-turbines. Although the units have not performed as expected to date, they have contributed to GHG reductions in the community from the combined electricity and heat production of the micro-turbines.

When natural gas becomes more readily available to northern communities, NTPC will consider the economics and GHG reduction benefits of retrofitting existing diesel power plants to natural gas.

Business As Usual Forecasting

Past projects that have resulted in GHG reductions are reflected in our forecast emissions for the period between 2006/07 and 2011/12. The use of techniques such as three-year weighted averages for fuel efficiencies and using the most recent year's data to forecast future years helps to capture the trends that result in GHG reductions and

Figure 6: GHG Emissions Percent Change Relative to Baseline Data



to represent them in forecasts. This is how we develop our "Business As Usual" forecasts which include existing efforts. This helps to improve our supply-side management through improved diesel engine efficiency programs, reduced station service, residual heat projects, upgraded streetlights, and reduced line losses from transmission and distribution systems.

Emissions Reductions Targets

As NTPC has successfully decreased its emissions below the 1990 Baseline and our own internal target of 10% below 1996/97 levels, we feel our "Business As Usual" forecast, capturing improved trends in our existing initiatives, is sufficient for the time being. Any major changes to our operating infrastructure will be adopted if they represent an economic benefit as well as a savings in GHG emissions.

RESULTS ACHIEVED & MEASURES TO ACHIEVE RESULTS

NTPC has successfully reduced GHG emissions through a number of programs since 1990/91. The following section describes individual initiatives taken in 2005/06 that contributed to GHG reductions and/or their impacts on future reductions.

NTPC endeavours to improve overall efficiency. Improving operating efficiency reduces reliance on fossil fuels to generate and distribute energy to customers. The benefits of improving efficiency reach beyond NTPC's direct emissions.

The vast geographic area and remoteness of the region means that significant resources and energy must be expended in order to transport fuel to each of NTPC's sites. By reducing the volume of fuel required to generate power the overall energy required to transport fuel to generating sites (derived from fossil fuels) is also reduced. All NTPC sites have fuel delivered via tanker truck or tug and barge.

Examples of individual projects undertaken by NTPC to reduce dependence on fossil fuels and production of GHG emissions during 2005/06 follow below. Table 7 summarizes the cumulative aggregate savings for all initiatives from 1990/91 to 2005/06. The table in Appendix 1 shows actual and forecast GHG emissions savings by gas type as well as total CO_2 equivalent emissions for all initiatives since 1990/91 forecast to 2011/12.

Table 7: Cumulative Aggregate Emissions Savings (Tonnes) from All Initiatives since 1990/91

CO_2 Equivalent Reductions (Tonnes) 1990/91—2005/06				
Alternative Generation/ Fuels	Station Service Reduction/ Residual Heat Projects	New Engine Upgrades/ PLCs	Streetlight Upgrades	Total
717,554	6,864	55,543	1,630	**781,592**

Fuel Efficient Engine Upgrades

In recent years, diesel engine technology has improved the overall fuel efficiency of engines while reducing emissions. Engine selection analysis is based primarily on life-cycle costs. The most significant of those life-cycle costs is fuel, which accounts for 85-90% of the capital and operating costs of a diesel engine over its life. Therefore, it is extremely important to replace aging equipment with the most fuel-efficient units available. In 2005/06 NTPC installed five new diesel engines in five remote NWT communities.

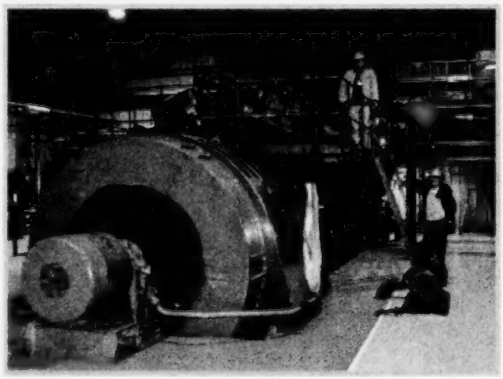
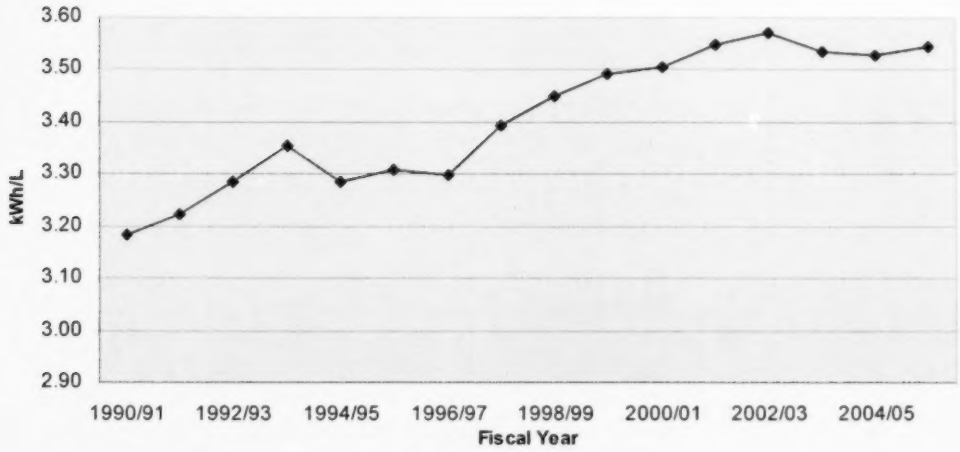


Figure 7 illustrates our Corporate efficiency trend. Yellowknife and Inuvik, two of our largest diesel generating plants, operate as backup diesel generators in the event that hydro or natural gas generation, respectively, become unavailable. Due to the low frequency with which these plants now operate, their fuel efficiencies have decreased accordingly. Therefore the Yellowknife and Inuvik plants have been excluded from this graph as they skew the data.

Figure 7: Corporate Fuel Efficiencies Excluding Yellowknife and Inuvik



The overall fuel efficiency for NTPC in 2005/06 (excluding standby plants) is 11% higher than the 1990/91 efficiency.

Our day-to-day operations, maintenance, and capital planning focus on maintaining or improving our fuel efficiency. Therefore our upward trend in fuel efficiencies is reflected in our forecasts for fuel consumption, and hence our forecast GHG emissions.

Programmable Logic Controllers (PLC)

Programmable Logic Controllers automate power plant diesel engines and help ensure that the appropriate engine is operating to most efficiently service fluctuating loads. This contributes to improved plant fuel efficiency. As it is impossible to separate PLC efficiency improvements and gains from upgrading to more fuel-efficient engines, the benefits of PLCs and new engines are calculated together in the Fuel Efficient Engine Upgrades section.

To date all but two plants have some level of PLC automation: Jean Marie River and Fort Smith, which are not yet slated for PLC automation.

Reduction in Station Service / Residual Heat Recovery

NTPC is continuously investigating ways to reduce its own consumption of power. Some of the equipment and design improvements utilized to reduce station service at our plants include:

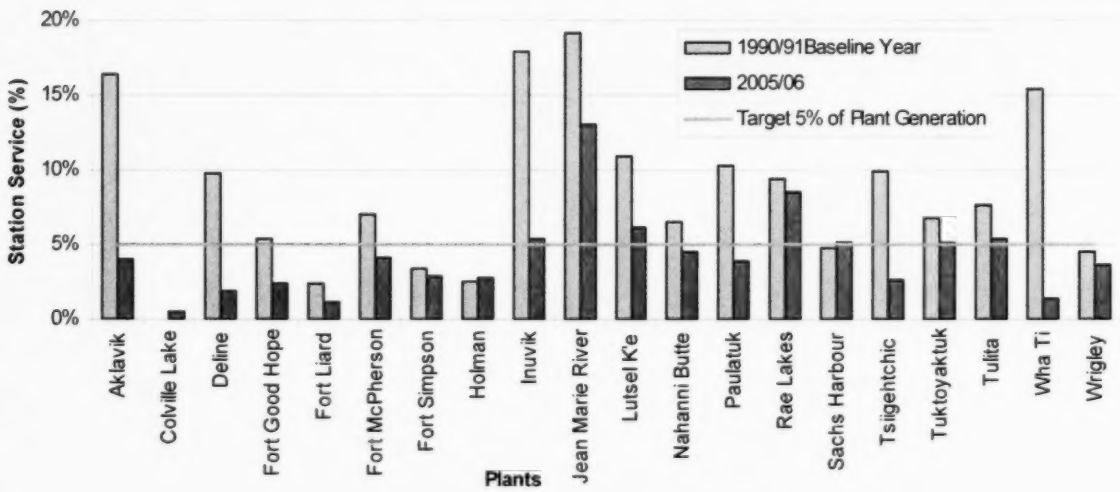
- replacement of in-plant electric space heating with residual heat from engine jacket water systems;
- replacement of engine electric block heaters with residual heat circuits that utilize jacket water heat from operating engines;
- replacement of inefficient lighting;
- installation of separate lighting circuits so that only specific lights are on at certain times;
- installation of variable frequency drives on radiators; and
- installation of photo sensors on all outside lighting.

Station service reductions have also come through the education and resulting heightened awareness of plant personnel. Small measures are highlighted, such as turning off lights when plants are unattended, turning heaters down or off when not required, and ensuring that any pipes or other equipment that require heat tracing during winter

months are shut-off during spring and summer months.

Since 1990/91 NTPC has successfully reduced overall Corporate station service. Through frequent audits of operations and diligent efforts to implement station service reducing technologies and practices we will continue to reduce our station service in future years. Figure 8 illustrates station service for NTPC diesel generating facilities (except standby plants) for 1990/91 and 2005/06. Note: there is no generation for Colville Lake in 1990/91 as the plant was commissioned in 1992.

Figure 8: Station Service for Diesel Plants (excluding standby plants) for 1990/91 and 2005/06



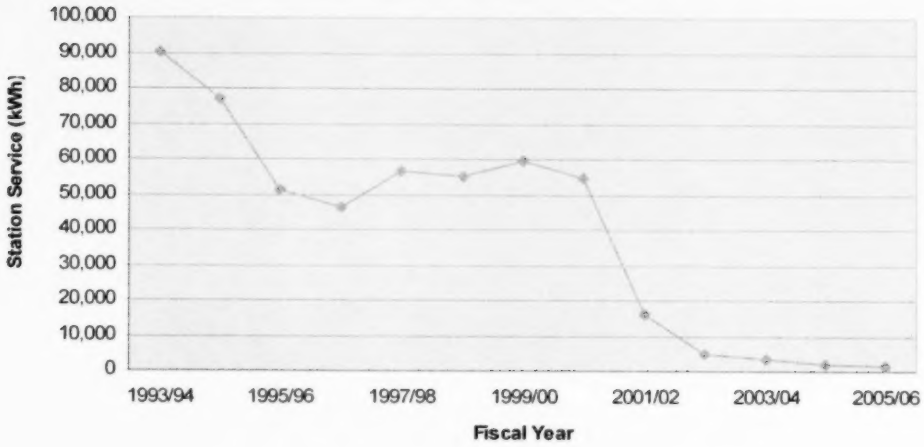
By diligently monitoring facility statistics, NTPC is able to identify sites where station service requirements are in excess of acceptable levels. NTPC set a target for each facility to achieve and maintain a station service less than or equal to 5% of its total generation. NTPC will continue to monitor station service and work to reduce it at the seven plants still exceeding the 5% target while maintaining all other site station service percentages below the target.

Colville Lake Residual Heat Project

In recent years, the Corporation has been a leader in a number of projects to recover and distribute waste heat from our diesel engines to both external customers and our own facilities. The most recent project involved upgrading the heating system at the Colville Lake diesel generating station in 2001/02.

Prior to 2001/02, the Colville Lake facility was heated electrically. Station service for this facility ranged from 20% to 37% of annual gross generation, well in excess of NTPC's acceptable level of 5%. In 2001/02, a retrofit of the modular plant was completed which provided residual heat for the plant, office/warehouse, and crew trailer. This resulted in a station service decrease of 38,763 kWh in the first partial year following installation, a further 11,191 kWh in 2002/03, a further 1,237 kWh in 2003/04, further to that 1,654 kWh in 2004/05, and 500 kWh more in 2005/06 (53,395 kWh in total) where it has levelled off. This translates into a decrease of nearly 55 tonnes of CO_2 equivalent GHG emissions resulting primarily from the utilization of residual heat. Figure 9 illustrates the Colville Lake facility station service since construction in 1993/94.

Figure 9: Colville Lake Station Service from 1993/94 to 2005/06



Alternative Generation Fuels / Methods

In recent years NTPC has undertaken a number of initiatives to reduce GHG emissions by utilizing alternative methods or fuel sources to generate power. Some of these initiatives have involved major capital projects such as the Inuvik Gas Project and major changes to hydro infrastructures. Simpler initiatives included the purchase of additional GHG-free hydropower. Some alternative generation methods are summarized below.

Bluefish Hydro Purchase

NTPC purchased the Bluefish hydro facility in the spring of 2003. The Bluefish hydro facility has been used primarily to serve Con Mine energy requirements. In November of 2003 Con Mine terminated mining operations. As mine operations require less energy, NTPC is able to displace diesel generation with Bluefish hydro generation to supply Yellowknife's electricity demands. Between 2006/07 and 2011/12 Bluefish hydropower will displace approximately 200,404 tonnes of CO_2e emissions.

Proposed Hydro Developments

NTPC continues to investigate the feasibility of additional hydro developments. The proposed Great Bear Hydro project has been researched since 2001 and is still in the pre-feasibility/conceptional stage. Although not included in the initial pipeline design, it is envisioned in the long term that energy from the Great Bear River would be used to supply power to the proposed Mackenzie Valley natural gas pipeline. The next major step in this project is to conduct feasibility and environmental studies. NTPC's second proposed new hydro initiative is the Taltson Hydro Expansion Project. This would involve the expansion of the existing Taltson hydro site to power the proposed Gahcho Kue mine site and the three operating diamond mines (Ekati, Diavik, and Snap Lake). In January 2007 a Project Description for this initiative will be submitted to the regulatory authorities, effectively triggering the permitting phase of development.

NTPC has worked closely with local aboriginal partners regarding power generation for each of the proposed projects. Life-cycle analyses of the pipeline and mines were carried out to determine both GHG and dollar savings when replacing natural gas and diesel generated electricity with hydroelectricity.

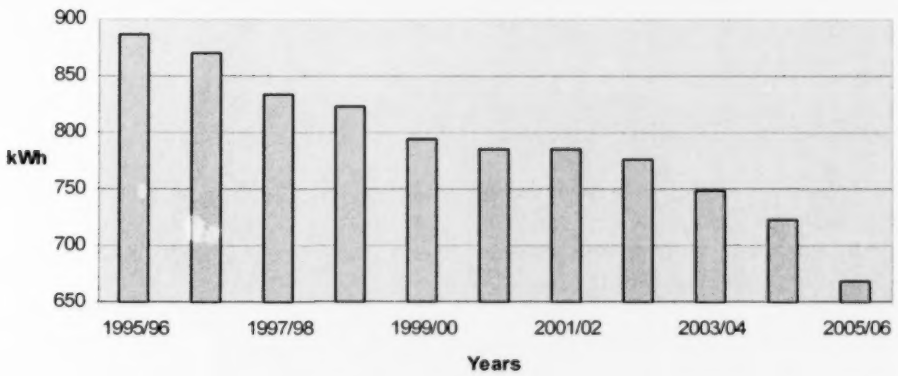
Mini Hydro in Lutsel K'e

NTPC has conducted a pre-feasibility study on the Lutsel K'e Mini-Hydro project. The project involves building a 500 - 1000 kW mini-hydro plant on the Snowdrift River to serve the Lutsel K'e electricity and heating requirements. Recommendations from the study are to proceed to a detailed feasibility study and investigate funding sources. If this project goes ahead it will reduce the community's annual diesel fuel consumption by about 800 kL, approximately 400 kL of which is currently used to generate electricity. Communications with the community began in December 2001 and are ongoing.

ment and Natural Resources (ENR) has been accessed to aid in the replacement of all MV streetlights in certain communities with HPS lights, which is a welcome boost to the program. For the remainder of the communities, HPS lights will be exchanged following the end-of-life of the existing MV lights. Figure 10 illustrates the average amount of energy required per streetlight in NTPC serviced communities. As more MV lights are replaced with the more efficient HPS lights, the average kWh required per streetlight decreases.

GHG savings from our continuing streetlight replacement program are shown in Table 7.

Figure 10: kWh per Streetlight per Year



Streetlight Replacement

NTPC is working with each individual community to decide whether to convert to High-Pressure Sodium (HPS) lighting from less efficient Mercury Vapour (MV) streetlights. In order to promote the program NTPC informs the communities of the benefits of conversion. We began converting community streetlights from MV to HPS during the 1995/96 fiscal year. To date, twelve communities have converted every streetlight in their community to HPS (three more than in 2004/05). Funding available from the GNWT Department of Environ-

Transmission and Distribution Lines

Line losses increase generation requirements, which contribute to increases in greenhouse gases. As required, transmission and distribution systems will be upgraded with new efficient conductors and transformers in order to reduce line losses.

Residential Energy Efficiency Program

Customer Research Surveys completed in 2000 and 2002 confirmed that customers would like more information on how to make their homes

more energy efficient. To meet their needs, NTPC implemented a Residential Energy Efficiency Program in 2002/03 targeting the 13 remote northern communities of the Delta-Sahtu region. This program proved highly successful with nearly 500 customers participating in the program. Each participant received valuable energy efficiency tips as well as energy saving light bulbs and an energy-efficient showerhead. The energy efficiency assessments showed that high power consumption was primarily caused by inefficient, outdated, or poorly maintained electrical appliances. Due to the success of this program in the Delta-Sahtu region, NTPC ran the program in the Deh Cho and North Slave regions in 2004/05 and in the South Slave region in 2005/06. The program included the following key objectives:

- To conduct comprehensive energy efficiency audits of residential homes;
- To provide customers with information pertaining to energy efficiency solutions and how to obtain them;
- To provide customers with information pertaining to climate change and how energy conservation can make a difference; and
- To discuss with customers any concerns regarding the service and electricity currently supplied to them by NTPC.

Now that all of our customers have been offered the program and due to its success it NTPC is hoping to offer the program again on a rotating basis.

Results in Comparison to Targets

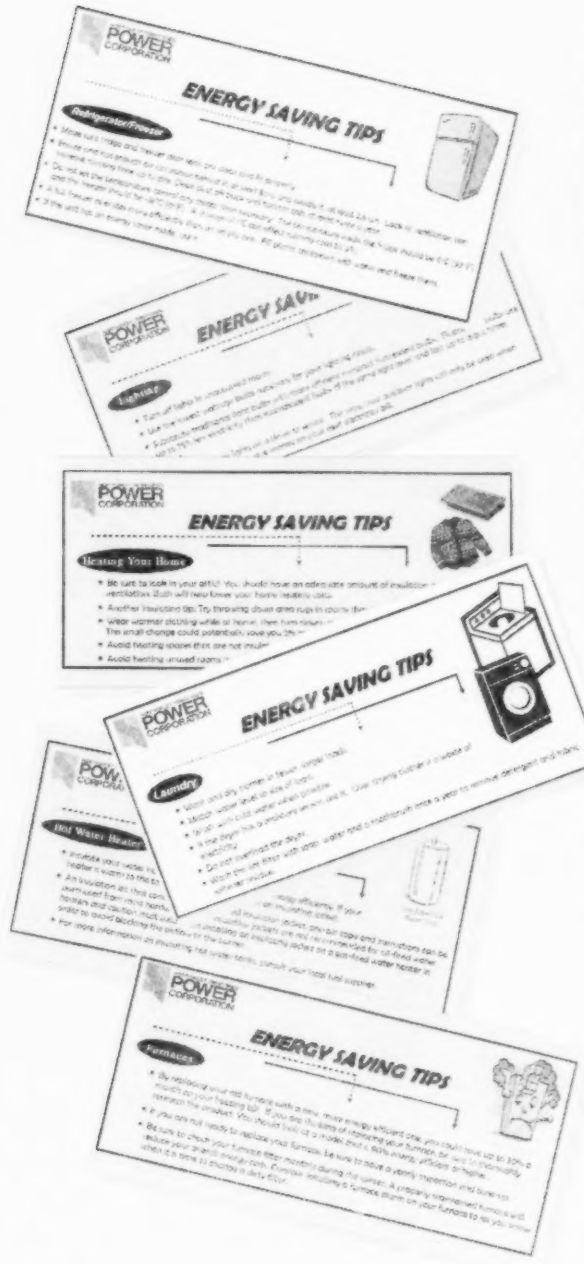
GHG Emissions

Our internal target to reduce GHG emissions by 10% of 1996/97 levels in 10 years was achieved by 1998/99. To date, we have reduced our cumulative CO_2 equivalent emissions by 781,592 tonnes and achieved a 58% decrease in 2005/06 from 1990/91 levels.

CO_2e Station Service Target

To date NTPC has successfully reduced station service at all but seven facilities to less than 5% of their total generations. NTPC will continue to monitor station service and, where feasible, implement training and technologies to reduce station service at the remaining seven diesel-generating facilities to meet the 5% target.

CLIMATE CHANGE AWARENESS



NTPC is committed to both employee and customer education regarding energy awareness. We hope to create an awareness of energy efficient practices and measures that can be implemented by all to ensure that the maximum benefit is derived from the electricity produced. Climate change issues are discussed in conjunction with many of our programs to promote energy awareness and conservation. The communication avenues discussed below are utilized to inform employees and the public of the many ways in which they can contribute to reductions in GHG production.

Our customer newsletter, **Energy @ Work**, provides energy-saving information that can be utilized within homes and communities to reduce energy demands.

Brief energy saving tips are printed on power bills and slips of paper containing additional tips are included in the envelopes with each monthly power bill.

The simple addition of a bicycle rack outside of our head office has provided an incentive for emissions reduction by employees, both inside and outside of work. As well, a number of employees across the Corporation make a point of walking to and from work. This is not only healthy for the individual and an environmentally friendly alternative to driving, but sets a good example for other members of their respective communities.

NTPC was awarded **Gold Champion Level Reporter** status by the Registry for our 2004/05 GHG report submission. This, along with all previous GHG reports, are made available on both our internal and external websites and our reporting status and awards are promoted to our customers through our website, on letterhead, and in local newspapers.

NTPC was a founding member of the **Arctic Energy Alliance** (AEA) and is a sustaining member today. The AEA is a not-for-profit organization established in 1997. The AEA's mandate is to help reduce the financial costs and environmental impacts associated with energy and utility services in the NWT, including GHG emissions.

On the **Supply-side Management** end, NTPC purchases fuel oil that is low in sulphur content (0.05%), as specified by the Canadian General Standards Board.

In 2001 NTPC ran a series of workshops for commercial customers to explain **Demand-side Management.** It was communicated that if customers could better manage their power usage to minimize peaking, they would save both money and power, at the same time reducing the production of greenhouse gases. In 2002, inspired by positive feedback from the workshops, NTPC began developing a fact sheet on demand-side management to be distributed to commercial customers.

These fact sheets, with such titles as *Understanding Demand Charges, Understanding your Power Bill*, and *Understanding Costs of Running Electrical Appliances* are distributed to both commercial and residential customers across the NWT. These brochures are produced to encourage customers to reduce their power consumption and to help understand how much electricity their electrical appliances really use.

As well, **Good News Posters** are now available to our employees and customers graphing such information as streetlight conversions, GHG emissions, and fuel usage.

All of our publications are available on our website at www.ntpc.com. The site also promotes NTPC's objective of reducing GHG emissions through reductions in customers' household energy usage.

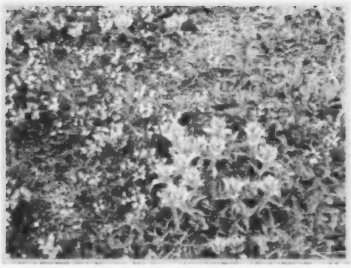
Internal Communications

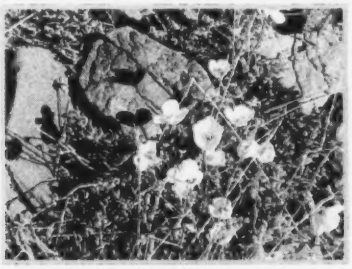
An employee-generated newsletter, **Powerline Plus**, is distributed to all employees on a monthly basis via email and our internal website. Articles include updates regarding NTPC's GHG emissions status and various ways to conserve energy. Employee updates are provided periodically by email and through regular meetings which provide information on proposed hydro developments and alternative energy generation.

NTPC annually provides environmental awareness training for employees covering topics such as minimizing station service, the importance of spill prevention, and an update on our greenhouse gas emissions.

CONCLUSION

The Northwest Territories Power Corporation has undertaken many successful initiatives towards reducing greenhouse gases. Our GHG reports demonstrate our commitment to combating climate change, as we believe that environmental issues should be at the forefront of all business. NTPC is committed to further reducing GHG emissions wherever feasible. We will continue to implement new ideas and strategies to conserve fuel usage and subsequent emissions while openly reporting our progress and initiatives.





For More Information Please Contact:

Northwest Territories Power Corporation
4 Capital Drive
Hay River, NT X0E 1G2

Telephone: 867 - 874 - 5200
Fax: 867 - 874 - 5251
Email: info@ntpc.com

Or visit our website at www.ntpc.com

Appendix A: NTPC Greenhouse Gas Emissions 1990/91 to 2011/12

																Actuals	Forecast					
	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Alternative Generation/ Fuels																						
Snare Cascades																						
CO_2							18,036	17,342	17,811	22,083	20,487	18,178	19,607	19,256	19,256	21,518	16,463	18,081	16,962	16,704	16,872	17,054
CH_4							0.86	0.83	0.85	1.05	0.98	0.87	0.93	0.92	0.92	1.02	0.78	0.86	0.81	0.80	0.80	0.81
N_2O							2.64	2.54	2.61	3.24	3.00	2.66	2.87	2.82	2.82	3.15	2.41	2.65	2.49	2.45	2.47	2.50
CO_2 Equiv.							18,873	18,147	18,638	23,108	21,438	19,022	20,518	20,149	20,149	22,517	17,227	18,920	17,749	17,480	17,655	17,846
Snare Rapids G2[1]																						
CO_2							2,387	1,954	1,954	1,503	2,551	2,410	867	191	115	116	-	-	-	-	-	
CH_4							0.11	0.09	0.09	0.07	0.12	0.11	0.04	0.01	0.01	0.01	-	-	-	-	-	
N_2O							0.35	0.29	0.29	0.22	0.37	0.35	0.13	0.03	0.02	0.02	-	-	-	-	-	
CO_2 Equiv.							2,498	2,045	2,045	1,572	2,669	2,522	907	200	121	121	-	-	-	-	-	
Norman Wells Purchased Power																						
CO_2	2,302	2,329	2,345	2,471	2,456	2,188	2,074	2,314	2,327	2,179	2,150	2,148	2,192	2,526	2,412	2,327	2,655	2,740	2,827	2,929	3,036	3,146
CH_4	-0.76	-0.77	-0.77	-0.82	-0.81	-0.72	-0.68	-0.76	-0.77	-0.72	-0.71	-0.71	-0.72	-0.83	-0.80	-0.77	-0.88	-0.90	-0.93	-0.97	-1.00	-1.04
N_2O	0.83		0.85	0.89	0.89	0.79	0.75	0.84	0.84	0.79	0.78	0.78	0.79	0.91	0.87	0.84	0.96	0.99	1.02	1.06	1.10	1.14
CO_2 Equiv.	2,545	2,574	2,592	2,731	2,715	2,419	2,292	2,558	2,572	2,408	2,376	2,374	2,423	2,791	2,666	2,571	2,935	3,029	3,125	3,238	3,355	3,477
Inuvik Gas Project																						
CO_2										1,873	3,734	4,092	3,214	3,136	3,170	3,161	3,600	3,648	3,693	3,766	3,841	3,917
CH_4										-1.29	-2.18	-2.49	-2.50	-2.60	-2.62	-2.54	-2.93	-2.97	-3.01	-3.07	-3.13	-3.19
N_2O										1.06	1.89	2.13	1.98	2.03	2.04	2.00	2.30	2.33	2.36	2.40	2.45	2.50
CO_2 Equiv.										2,174	4,274	4,701	3,776	3,710	3,749	3,727	4,250	4,307	4,361	4,447	4,535	4,624
Bluefish Purchased Power																						
CO_2			18,389	18,922	15,539	24,531	34,228	32,615	27,403	35,331	38,432	39,694	36,842	35,632	24,974	31,810	31,555	23,137	31,554	35,089	35,089	35,089
CH_4			0.88	0.90	0.74	1.17	1.63	1.55	1.30	1.68	1.83	1.89	1.75	1.70	1.19	1.51	1.50	1.10	1.50	1.67	1.67	1.67
N_2O			2.69	2.77	2.28	3.59	5.02	4.78	4.02	5.18	5.63	5.82	5.40	5.22	3.66	4.66	4.62	3.39	4.62	5.14	5.14	5.14
CO_2 Equiv.			19,243	19,801	16,260	25,669	35,817	34,129	28,675	36,971	40,216	41,537	38,552	37,287	26,133	33,287	33,020	24,211	33,019	36,718	36,718	36,718

[1] Snare Rapids G2 unit does not operate during average to low water years. As forecasting for the hydro system assumes average water levels. zero G2 generation is also forecast. However, on average, the G2 unit has accounted for approximately 0.02% of the total Snare hydro generation since installation, so some generation is anticipated even if not forecast.

Appendix A: NTPC Greenhouse Gas Emissions 1990/91 to 2011/12

																Actuals	Forecast					
	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Station Service Reduction/Residual Heat Projects																						
Station Service/Residual Heat Savings																						
CO_2		163	100	242	295	385	319	297	349	194	161	172	173	155	199	202	171	171	171	171	171	171
CH_4		0.01	0.00	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
N_2O		0.02	0.01	0.04	0.04	0.06	0.05	0.04	0.05	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02
CO_2 Equiv.		170	104	253	309	402	334	311	366	203	168	180	181	163	208	211	178	178	178	178	178	178
Fort McPherson Residual Heat																						
CO_2								511	423	473	450	479	440	156	0	224	351	351	351	351	351	351
CH_4								0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02
N_2O								0.07	0.06	0.07	0.07	0.07	0.06	0.02	0.00	0.03	0.05	0.05	0.05	0.05	0.05	0.05
CO_2 Equiv.								534	443	495	471	501	460	163	0	234	367	367	367	367	367	367
New Engine Upgrades/PLCs																						
Improved Fuel Efficiency Savings																						
CO_2		1,655	1,375	2,907	3,295	3,879	4,169	4,107	5,129	3,660	3,571	3,975	4,349	4,170	4,140	4,257	3,978	3,990	3,984	3,992	4,000	4,005
CH_4		0.08	0.07	0.14	0.16	0.18	0.20	0.20	0.24	0.17	0.17	0.19	0.21	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19
N_2O		0.24	0.20	0.43	0.48	0.57	0.61	0.60	0.75	0.54	0.52	0.58	0.64	0.61	0.61	0.62	0.58	0.58	0.58	0.58	0.59	0.59
CO_2 Equiv.		1,732	1,439	3,042	3,448	4,059	4,363	4,297	5,367	3,830	3,737	4,159	4,551	4,364	4,332	4,455	4,163	4,175	4,169	4,177	4,186	4,191
Streetlight Upgrades																						
Streetlight Savings																						
CO_2							24	82	94	131	155	150	172	226	274	354	354	354	354	354	354	354
CH_4							0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
N_2O							0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
CO_2 Equiv.							25	85	98	137	162	157	180	237	286	286	370	370	370	370	370	370
Annual Totals																						
CO_2	2,302	4,147	22,208	24,542	21,585	30,982	61,238	59,220	55,490	67,426	71,690	71,297	67,857	65,449	54,540	63,968	59,125	52,470	59,894	63,356	63,712	64,086
CH_4	-0.76	-0.68	0.17	0.24	0.10	0.65	2.13	1.95	1.76	1.01	0.25	-0.10	-0.25	-0.58	-1.08	-0.52	-1.29	-1.68	-1.40	-1.34	-1.42	-1.51
N_2O	0.83	1.11	3.76	4.13	3.69	5.01	9.42	9.18	8.63	11.13	12.31	12.44	11.93	11.70	10.09	11.39	11.00	10.07	11.20	11.77	11.88	11.99
CO_2 Equiv.	2,545	4,477	23,377	25,827	22,731	32,549	64,178	62,020	58,105	70,762	75,349	74,995	71,369	68,827	57,359	67,123	62,139	55,187	62,967	66,605	66,994	67,402
Cumulative Totals Since 1990/91																						
CO_2	2,302	6,450	28,658	53,200	74,785	105,767	167,005	226,225	281,715	349,141	420,831	492,128	559,985	625,434	677,671	737,492	803,067	855,536	915,431	978,787	1,042,499	1,104,282
CH_4	-0.76	-1.44	-1.27	-1.04	-0.94	-0.29	1.85	3.79	5.56	6.56	6.81	6.71	6.46	5.87	5.55	5.71	2.98	1.29	-0.10	-1.44	-2.86	-3.62
N_2O	0.83	1.94	5.70	9.83	13.52	18.53	27.95	37.13	45.76	56.89	69.20	81.65	93.57	105.27	114.53	124.81	137.76	147.83	159.03	170.80	182.67	193.83
CO_2 Equiv.	2,545	7,022	30,399	56,225	78,957	111,506	175,683	237,704	295,808	366,570	441,920	516,914	588,283	657,110	714,469	781,592	843,731	898,918	961,885	1,028,490	1,095,484	1,160,341

The Northwest Territories Power Corporation would like to thank the following people for their contributions to the 2005/06 Greenhouse Gas Report:

Myra Berrub
Suzanne Bouchard
Kirk Carston
Leon Courneya
Drew Farmer
April Glaicar
Raymond Gonzales
Paul Grant
Greg Haist
Patricia Harrington
Darren Huculak
Dean Hendrickson
Stephen Kerr
Mark Riche
Jean Ramsay
Jayda Robillard
Robert Schmidt
Edward Smith
Glenn Smith
Joe Staszuk
Brian Willows